

**WHAT IS CLAIMED IS:**

1. A method of improving attribute uniformity of substrates processed by a lithographic system having exposure apparatus to expose substrates, pre-exposure apparatus to process substrates prior to exposure, and post-exposure apparatus to process substrates after exposure, said method comprising:

measuring attributes of substrates processed by said lithographic system;

assessing whether said measured substrate attributes are uniform based on pre-specified substrate profile information;

adaptively calculating corrective exposure data based on said measured substrate attributes upon determining that said measured substrate attributes are not uniform, said corrective exposure data configured to correct non-uniformities of said substrate attributes by regulating exposure dosage in said exposure apparatus of said lithographic system; and

exposing substrates in accordance with said corrective exposure data.

2. The method of Claim 1, further including storing collections of said corrective exposure data as correction maps.

3. The method of Claim 2, wherein said adaptive calculation of corrective exposure data includes,

acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

determining exposure dosage gain factor,

acquiring history of previously-processed substrates,

correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

wherein said iterative corrective exposure data calculation and updating continues until said substrate attributes are determined to be uniform.

4. The method of Claim 3, further including, monitoring and verifying said correction map correlations by a logic mechanism, and communicating, by said logic mechanism, with at least one of said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes.

5. The method of Claim 4, further including, monitoring, by said logic mechanism, said substrate attributes upon determining that said substrate attributes are uniform, and initiating, by said logic mechanism, invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.

6. The method of Claim 3, wherein said processing module information further includes data associated with processing path of said substrates processed by said specific apparatus of said pre-exposure apparatus and post-exposure apparatus.

7. The method of Claim 5, wherein said iterative corrective exposure data calculation and updating, said monitoring of said substrate attributes, and said initiating invocation of corrective exposure data calculation and updating are controlled by said logical mechanism.

8. The method of Claim 3, wherein said determining exposure dose gain factor includes determining change in said measured attributes of said substrates per unit of exposure dosage.

9. The method of Claim 7, further including providing a user interface to communicate information regarding at least one of said exposure apparatus, said pre-exposure apparatus, said post-exposure apparatus, said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, said measured substrate attributes, and said logical mechanism.

10. The method of Claim 2, further including,  
acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus and processing paths used in processing said substrates,

acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

determining exposure dosage gain factor including calculating change in said measured attributes of said substrates per unit of exposure dosage,

acquiring history of previously-processed substrates,

correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes, and

providing a logical mechanism,

wherein said logical mechanism monitors, controls, and enables said iterative corrective exposure data calculation and updating to continue until said substrate attributes are determined to be uniform upon determining that said substrate attributes are uniform, and

wherein said logical mechanism initiates invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.

11. A lithographic system that improves attribute uniformity of substrates, comprising:

- exposure apparatus configured to expose substrates;
- pre-exposure apparatus configured to process substrates prior to exposure;
- track apparatus operatively coupled to said exposure apparatus and a plurality of processing modules;
- post-exposure apparatus configured to process substrates after exposure;
- a measuring device configured to measure attributes of said substrates; and
- a corrective exposure module that adaptively calculates corrective exposure data based on said measured attributes upon determining that said substrates are not uniform, wherein said corrective exposure data are configured to correct non-uniformities in said substrates by regulating exposure dosage in said exposure apparatus, and wherein said substrates are exposed by said exposure apparatus in accordance with said corrective exposure data.

12. The system of Claim 11, wherein collections of said corrective exposure data are stored as correction maps in a correction map library.

13. The system of Claim 12, wherein said adaptive calculation of corrective exposure data of said corrective exposure module includes,

- acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

- acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

- determining exposure dosage gain factor,

- acquiring history of previously-processed substrates,

- correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain

factor, and said measured substrate attributes,

iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

wherein said iterative corrective exposure data calculation and updating continues until said substrate attributes are determined to be uniform.

14. The system of Claim 13, further including a logical mechanism to monitor and verify said correction map correlations, said logical mechanism configured to communicate with at least one of said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes.

15. The system of Claim 14, wherein said logic mechanism monitors said substrate attributes upon determining that said substrate attributes are uniform, and initiates invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.

16. The system of Claim 13, wherein said processing module information further includes data associated with processing path of said substrates processed by said specific apparatus of said pre-exposure apparatus and post-exposure apparatus.

17. The system of Claim 15, wherein said iterative corrective exposure data calculation and updating, said monitoring of said substrate attributes, and said initiating invocation of corrective exposure data calculation and updating are controlled by said logical mechanism.

18. The system of Claim 13, wherein said determining exposure dose gain factor includes determining change in said measured attributes of said substrates per unit of exposure dosage.

19. The system of Claim 17, further including a user interface to communicate information regarding at least one of said exposure apparatus, said pre-exposure apparatus, said post-exposure apparatus, said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, said measured substrate attributes, and said logical mechanism.

20. The system of Claim 12, wherein said adaptive calculation of corrective exposure data of said corrective exposure module includes,

acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus and processing paths used in processing said substrates,

acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

determining exposure dosage gain factor including calculating change in said measured attributes of said substrates per unit of exposure dosage,

acquiring history of previously-processed substrates,

correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes, and

providing a logical mechanism,

wherein said logical mechanism monitors, controls, and enables said iterative corrective exposure data calculation and updating to continue until said substrate attributes are determined to be uniform upon determining that said substrate attributes are uniform, and

wherein said logical mechanism initiates invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.

21. A computer readable program storage device encoded with instructions that, when executed by a computer, performs a process of improving attribute uniformity of substrates processed by a lithographic system having exposure apparatus to expose substrates, pre-exposure apparatus to process substrates prior to exposure, and post-exposure apparatus to process substrates after exposure, said process comprising:

measuring attributes of substrates processed by said lithographic system;

assessing whether said measured substrate attributes are uniform based on pre-specified substrate profile information;

adaptively calculating corrective exposure data based on said measured substrate attributes upon determining that said measured substrate attributes are not uniform, said corrective exposure data configured to correct non-uniformities of said substrate attributes by regulating exposure dosage in said exposure apparatus of said lithographic system; and

exposing substrates in accordance with said corrective exposure data.

22. The computer readable program storage device of Claim 21, further including storing collections of said corrective exposure data as correction maps.

23. The computer readable program storage device of Claim 22, wherein said adaptive calculation of corrective exposure data includes,

acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

determining exposure dosage gain factor,

acquiring history of previously-processed substrates,

correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,



iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

wherein said iterative corrective exposure data calculation and updating continues until said substrate attributes are determined to be uniform.

24. The computer readable program storage device of Claim 23, further including, monitoring and verifying said correction map correlations by a logic mechanism, and communicating, by said logic mechanism, with at least one of said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes.

25. The computer readable program storage device of Claim 24, further including, monitoring, by said logic mechanism, said substrate attributes upon determining that said substrate attributes are uniform, and

initiating, by said logic mechanism, invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.

26. The computer readable program storage device of Claim 23, wherein said processing module information further includes data associated with processing path of said substrates processed by said specific apparatus of said pre-exposure apparatus and post-exposure apparatus.

27. The computer readable program storage device of Claim 25, wherein said iterative corrective exposure data calculation and updating, said monitoring of said substrate attributes, and said initiating invocation of corrective exposure data calculation and updating are controlled by said logical mechanism.

28. The computer readable program storage device of Claim 23, wherein said determining exposure dose gain factor includes determining change in said measured attributes



of said substrates per unit of exposure dosage.

29. The computer readable program storage device of Claim 27, further including providing a user interface to communicate information regarding at least one of said exposure apparatus, said pre-exposure apparatus, said post-exposure apparatus, said correction maps, said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, said measured substrate attributes, and said logical mechanism.

30. The computer readable program storage device of Claim 22, further including, acquiring processing module information based on information of specific apparatus of said pre-exposure apparatus and post-exposure apparatus and processing paths used in processing said substrates,

acquiring metrology information including information associated with said specific apparatus of said pre-exposure apparatus and post-exposure apparatus used in processing said substrates,

determining exposure dosage gain factor including calculating change in said measured attributes of said substrates per unit of exposure dosage,

acquiring history of previously-processed substrates,

correlating each of said correction maps to at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes,

iteratively calculating and updating said corrective exposure data based on at least one of said processing module information, said metrology information, said substrate history, said exposure dosage gain factor, and said measured substrate attributes, and

providing a logical mechanism,

wherein said logical mechanism monitors, controls, and enables said iterative corrective exposure data calculation and updating to continue until said substrate attributes are determined to be uniform upon determining that said substrate attributes are uniform, and

wherein said logical mechanism initiates invocation of corrective exposure data calculation and updating upon determining that said substrate attributes are no longer uniform.